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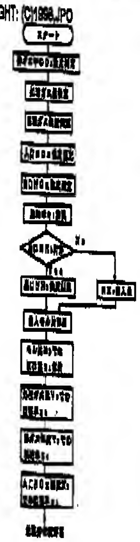
## (54) WASTE GAS DENITRATION METHOD AND DEVICE THEREFOR

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a method capable of confirming a denitration performance based on an usual operation data and to provide a waste gas denitration method and device capable of forecasting a catalyst replacing or increasing time by executing a forecast of a catalyst life.

SOLUTION: At the time of purifying the waste gas with a denitration catalyst in the presence of the reducing agent, a denitration rate at $NOx/NH_3$ molar ratio in the waste gas at an evaluation condition, the denitration rate at waste gas amount at the evaluation condition, the denitration rate at waste gas temp. at the evaluation condition or the denitration rate at the NOx concn. at a denitration device inlet are required respectively by using a waste gas amount, waste gas temp., NOx concn. at a denitration device inlet, NOx concn. at a denitration device outlet, $NH_3$ amount to be injected to the denitration device and $NH_3$ amount at the denitration device outlet as a data concerning the denitration performance, and a degradation degree of the denitration catalyst is evaluated by these denitration rate.







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[Document Name] Description

[Title of the Invention] The exhaust gas denitrogenization method and equipment

[Claim(s)]

[Claim 1] The exhaust gas denitrogenization method characterized by recording the data about denitrogenization performance, converting into predetermined evaluation conditions in the exhaust gas denitrogenization method which purifies exhaust gas according to a NOx removal catalyst under existence of a reducing agent, evaluating denitrogenization performance, and evaluating the degree of degradation of a NOx removal catalyst.

[Claim 2] As data about denitrogenization performance, the amount of exhaust gas, exhaust gas temperature, NOx removal equipment entrance NOx concentration, NOx removal equipment exit NOx concentration, pouring NH3 quantity to NOx removal equipment, and NOx removal equipment exit NH3 quantity are used. The NOx removal efficiency in the molar ratio of the ammonia in exhaust gas to NOx in exhaust gas at the time of evaluation conditions, The exhaust gas denitrogenization method according to claim 1 which searches for the NOx removal efficiency in the amount of exhaust gas at the time of evaluation conditions, the NOx removal efficiency in the exhaust gas temperature at the time of evaluation conditions, or the NOx removal efficiency in the NOx removal equipment entrance NOx concentration at the time of evaluation conditions, and is characterized by evaluating the degree of degradation of a NOx removal catalyst according to such NOx removal efficiency.

[Claim 3] The amount of exhaust gas is the exhaust gas denitrogenization method according to claim 1 or 2 characterized by asking with the function which measures the amount of direct flue gas, or calculates an amount of combustion gas from the air content for combustion.

[Claim 4] The exhaust gas denitrogenization method according to claim 1 to 3 characterized by using for exhaust gas processing from an incinerator.

[Claim 5] The amount of exhaust gas is the exhaust gas denitrogenization method according to claim 4 characterized by asking with a predetermined function from the amount of refuse disposal, the calorific value of garbage, and incinerator exit oxygen concentration.

[Claim 6] It is the exhaust gas denitrogenization method according to claim 5 characterized by calculating the calorific value of garbage by a predetermined function from incinerator exit oxygen concentration.

[Claim 7] In the exhaust gas NOx removal equipment by the catalytic reduction method which purifies exhaust gas according to a NOx removal catalyst under existence of a reducing agent Each detection means of the amount of exhaust gas, exhaust gas temperature, NOx removal equipment entrance NOx concentration, NOx removal equipment exit NOx concentration, pouring NH3 quantity to NOx removal equipment, and NOx removal equipment exit NH3 quantity, The NOx-removal-efficiency calculation means in the molar ratio of the ammonia in exhaust gas [ as opposed to NOx in exhaust gas at the time of evaluation conditions based on the detection value of each of said detection means ], Exhaust gas NOx removal equipment characterized by establishing the NOx-removal-efficiency calculation means in the NOx removal equipment entrance NOx concentration at the time of the NOx removal efficiency in the NOx-removal-efficiency calculation means in the amount of exhaust gas at the time of evaluation conditions, and the exhaust gas temperature at the time of evaluation conditions, or evaluation conditions.

[Claim 8] Exhaust gas NOx removal equipment according to claim 7 characterized by using for exhaust gas processing from an incinerator.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the exhaust gas denitrogenization method and equipment with easy performance management of the NOx removal catalyst which was suitable for the catalyst NOx removal equipment of refuse incineration equipment about the exhaust gas denitrogenization method and equipment.

[0002]

[Description of the Prior Art] The flue-gas-denitrogenization method by the alternative contact reduction which used ammonia (NH3) as the reducing agent is broadly used as a method of removing the nitrogen oxide (NOx) in the exhaust gas discharged from a thermal power plant, various factories, etc. Said exhaust gas is operated where the quantity, quality, etc. are stabilized mostly, and evaluation management of denitrogenization performance is performed comparatively easily by everyday operation management.

[0003] Since it combines with the increase in such a plant being expected further from now on from many situations, such as an increase in population, and reduction of a reclamation lot, about a municipal-solid-waste incineration system and is installed in the urban-areas suburbs on the other hand, Sufficient smoke-eliminating processing is required and it is necessary to attach exhaust gas denitrizer to a municipal-solid-waste incineration system.

[0004] In a municipal-solid-waste incineration system, the quality of the garbage to process differs, and since the amount of garbage injections to an incinerator is not constant, either, the amount of exhaust gas is uncontrollable with a season, the weather, and a time zone. Thus, since gas conditions are sharply changed with the quality of garbage, the amount of injections, etc., from the usual performance data, it is difficult also for the performance of catalyst NOx removal equipment to perform the right evaluation.

[0005] [ this ] in order to grasp denitrogenization performance By making into a sample the catalyst of the specification general and usually same as the catalyst with which it was filled up, the method of evaluating by carrying out direct measurement of a catalyst's own degradation state inserted from the side of the NOx removal reactor etc., extracted it periodically, and after measuring performance, it was carrying out conversion evaluation at system plan conditions. and a basis [ evaluation result / this ] -- exchange of a catalyst -- stacking -- increase -- time -- it had measured. For this reason, the number of times of the catalyst quality assessment increased, and catalyst degradation was not able to be evaluated promptly, such as performing this in the pitch of a years time.

[0006] Moreover, there were also many cases which a big difference produces in said sample catalyst and a system catalyst, and the method in particular of catalyst life management of the NOx removal equipment for refuse incineration equipment was not

what was established.

[0007]

[Problem to be solved by the invention] Exhaust gas conditions do not fix refuse incineration equipment with quality, the amount of injections, etc. of garbage. Since gas volume, entrance NOx concentration, etc. changed continuously when the performance of NOx removal equipment is managed only with the performance data (Exit NOx, the NH3 amount used, etc.) about the usual denitrogenization managed, there was a problem that the quality assessment in the same conditions was not made and grasp of exact denitrogenization performance could not be performed. The technical problem of this invention loses the fault of the above-mentioned conventional technology, is offering the method of denitrogenization performance making it possible based on the usual performance data, performs catalyst life prediction, and there is in offering the exhaust gas denitrogenization method and equipment which can predict catalyst exchange or product increase time.

[0008]

[Means for solving problem] The technical problem of above-mentioned this invention is solved by the next composition. That is, in the exhaust gas denitrogenization method which purifies exhaust gas according to a NOx removal catalyst under existence of a reducing agent, it is the exhaust gas denitrogenization method of recording the data about denitrogenization performance, converting into predetermined evaluation conditions, evaluating denitrogenization performance, and evaluating the degree of degradation of a NOx removal catalyst.

[0009] As data about said denitrogenization performance, for example, the amount of exhaust gas, exhaust gas temperature, NOx removal equipment entrance NOx concentration, NOx removal equipment exit NOx concentration, pouring NH3 quantity to NOx removal equipment, Using NOx removal equipment exit NH3 quantity, the NOx removal efficiency in the NH3/NOx molar ratio in exhaust gas at the time of evaluation conditions, The NOx removal efficiency in the amount of exhaust gas at the time of evaluation conditions, the NOx removal efficiency in the exhaust gas temperature at the time of evaluation conditions, or the NOx removal efficiency in the NOx removal equipment entrance NOx concentration at the time of evaluation conditions is searched for, and such NOx removal efficiency estimates the degree of degradation of a NOx removal catalyst.

[0010] Here, the amount of exhaust gas can be calculated with the function which

measures the amount of direct flue gas, or calculates an amount of combustion gas from the air content for combustion.

[0011] The technical problem of above-mentioned this invention is solved by the next composition. Namely, it sets to the exhaust gas NOx removal equipment by the catalytic reduction method which purifies exhaust gas according to a NOx removal catalyst under existence of a reducing agent. Each detection means of the amount of exhaust gas, exhaust gas temperature, NOx removal equipment entrance NOx concentration, NOx removal equipment exit NOx concentration, pouring NH3 quantity to NOx removal equipment, and NOx removal equipment exit NH3 quantity, Based on the detection value of each of said detection means, the NOx-removal-efficiency calculation means in the NH3/NOx molar ratio at the time of evaluation conditions, It is the exhaust gas NOx removal equipment which established the NOx-removal-efficiency calculation means in the amount of exhaust gas at the time of evaluation conditions, the NOx-removal-efficiency calculation means in the exhaust gas temperature at the time of evaluation conditions, or the NOx-removal-efficiency calculation means in the NOx removal equipment entrance NOx concentration at the time of evaluation conditions.

[0012] Moreover, this invention can be used for exhaust gas processing from an incinerator, and can calculate the amount of exhaust gas in that case with a predetermined function from the amount of refuse disposal, the calorific value of garbage, and incinerator exit oxygen concentration. Moreover, the calorific value of garbage can also be calculated with a predetermined function from incinerator exit oxygen concentration. As the above-mentioned refuse incineration equipment, equipment of a stalker method, a fluid bed method, a kiln method, or a machine batch method is used.

[0013]

[Function] Denitrogenization performance is mainly influenced by the amount of exhaust gas, NOx removal equipment entrance NOx concentration, gas temperature, and the NH3/NOx molar ratio (NH3 injection rate). Then, the denitrogenization performance in an actual measurement is converted to plan conditions by making the relation of each influence factor and denitrogenization performance into a function using the function of the relation between an influence factor and NOx removal efficiency about each influence factor. For example, the survey amount of exhaust gas and survey NOx removal efficiency are inputted to the variable in a function, and this asks for the denitrogenization performance in plan conditions. In this way, even if it is the case where exhaust gas conditions change with change of garbage quality etc. continuously, for example, the performance comparison by the basis of certain conditions is always possible, and grasp of degradation etc. can be performed easily.

[0014]

[Mode for carrying out the invention] The form of operation of this invention is explained below. Refuse incineration equipment of one work example of this invention is shown in drawing 1. Although the composition of the apparatus which constitutes it according to the scale of refuse incineration equipment differs somewhat, the refuse incineration equipment shown in drawing 1 is common.

[0015] The exhaust gas discharged from the incinerator 1 passes along a condensator 2, the alkali spray tower 3, and the bug filter 4. NH3 used as a reducing agent are poured into the flue 7 by the side of the style before NOx removal reactor 5, NOx in exhaust gas is removed by operation of the NOx removal catalyst with which it filled up in NOx removal reactor 5, and the purified exhaust gas is discharged from a chimney 6. Air is supplied to the incinerator 1 from an air fan, and garbage is thrown in from an entrance slot 16. In addition, the air for combustion is introduced into the incinerator 1 from the air fan 15 having the airometer 13.

[0016] To the flue 7 of the style before NOx removal reactor 5, Entrance NOx, O2 analysis 8 [ a total of ] (it samples from one measurement seat and measures with a NOx analysis meter and O2 analysis plan, respectively.), The exhaust gas flow instrument 11 and the exhaust gas thermometer 14 are arranged, and Exit NOx, O2 analysis 9 [ a total of ], and exit NH3 analysis 10 [ a total of ] are ****-it-arranged at the flue 7 of NOx removal reactor 5 slipstream, and NH3 injection rate is measured with NH3 flow instrument 12.

[0017] As the data about the performance of NOx removal equipment is recorded and the control block diagram of this example is shown in drawing 2 in such a system, a computer with the function converted into certain evaluation conditions is formed, and it carries out as [ be / evaluation of equipment performance / possible ] if needed. The procedure is explained hereafter.

[0018] (1) The amount of exhaust gas according to the exhaust gas flow instrument 11 in the flue 7 of bug filter 4 slipstream as the above-mentioned evaluation factor, Entrance NOx, the entrance NOx concentration measured by O2 analysis 8 [ a total of ], Exit NOx, The molar ratio of NOx in exhaust gas to pouring NH3 to NOx removal reactor 5 for which it asked from the exit NOx concentration measured by O2 analysis 9 [ a total of ] and exit NH3 concentration measured by exit NH3 analysis 10 [ a total of ] (-- it may be hereafter called a pouring molar ratio) -- [ it uses, and a denitrogenization quality assessment value is calculated with the function about each influence factor, and ] It converts to certain evaluation conditions (if a molar ratio is calculated from NH3 poured-in quantity, theory is not suited in many cases, and a molar ratio with more exact asking

from exit $NH_3$ concentration, Entrance NOx, and NOx removal efficiency is obtained.). For this reason, when there is exit $NH_3$ analysis 10 [ a total of ], a molar ratio is computed from exit $NH_3$ concentration. .

[0019] (2) When not installing exit $NH_3$ analysis 10 [ a total of ] among the evaluation factors of the above (1), from $NH_3$ flux measured with the flow instrument 12 which detects the flux of $NH_3$ which are a reducing agent, ask for a pouring molar ratio and convert with each influence factor.

[0020] (3) Among the evaluation factors of the above (1), the amount of exhaust gas incorporates and calculates the function (the gas volume characteristic in real gas is arranged and function-ized by a relation with an air content.) which calculates an amount of combustion gas from the air content measured with air content 13 [ a total of ] for refuse incineration, and converts it with each influence factor.

[0021] In order to calculate the amount of exhaust gas among the evaluation factors of the above (1), garbage quality according to a season (4) Low quality, The function (the gas volume characteristic in real gas is arranged and function-ized by a relation with a season.) which calculates respectively the amount of exhaust gas which makes a function the season in the time of using and evaluating $O_2$ analysis a total of eight measured value of an incinerator exit to the calorific value of the garbage corresponding to this garbage quality since it usually reaches and is classified into the nature garbage of high is incorporated. It converts with each influence factor.

[0022] Each influence factor which was measured as mentioned above or was called for is taken in in computers, such as a central operation room of a plant, and is converted to fixed evaluation conditions by the method described below for every influence factor.

[0023] In addition, the denitrogenization performance at the time of operation is usually called for by the following formula from Entrance NOx, the entrance NOx concentration measured by $O_2$ analysis 8 [ a total of ], and Exit NOx and the exit NOx concentration measured by $O_2$ analysis 9 [ a total of ]. NOx-removal-efficiency eta1= {(entrance NOx-exit NOx) /entrance NOx} x100 (%)

[0024] (1) There is a relation as indicated to be the pouring molar ratio calculated from pouring molar ratio exit $NH_3$ concentration or $NH_3$ poured-in quantity and NOx removal efficiency to drawing 4. Along with a curve, NOx removal efficiency eta 2 at the time of molar ratio (molar ratio to NOx in exhaust gas of $NH_3$ in exhaust gas) MD in evaluation conditions (a plan molar ratio or the molar ratio when usually evaluating performance in

each plant is called evaluation conditions.) can be found in NOx removal efficiency eta 1 and the pouring molar ratio Mm for which it asked by the upper formula.

[0025] (2) Although it has a relation as shown in drawing 5 between the amount-of-exhaust-gas amount of exhaust gas and NOx removal efficiency and the intersection of NOx removal efficiency eta 2 searched for above (1) has the system amount of exhaust gas Vm on the curve shown in drawing 5, if it moves along with this curve, NOx removal efficiency eta 3 in the amount of exhaust gas VD in evaluation conditions can be found.

[0026] (3) The relation between gas temperature exhaust gas temperature and NOx removal efficiency has a relation as shown in drawing 6, the measurement gas temperature Tm and NOx removal efficiency eta 3 searched for by the above (2) are moved to the time of the exhaust gas temperature TD in evaluation conditions along with a curve, and NOx removal efficiency eta 4 can be found.

[0027] (4) The relation between entrance NOx concentration NOx concentration and NOx removal efficiency has a relation as shown in drawing 7, the measurement entrance NOx concentration Nm and NOx removal efficiency eta 4 searched for by the above (3) are moved to the entrance NOx concentration ND in evaluation conditions along with a curve, and NOx removal efficiency eta 5 can be found.

[0028] It becomes the value which acquired the NOx removal efficiency (measured NOx removal efficiency) in each influence factor which this NOx removal efficiency eta 5 measured by having converted it into certain evaluation conditions, and management of the denitrogenization performance in the basis of the same conditions is always attained. The degradation state of denitrogenization performance can manage daily by this, and improvement in reliability of NOx removal equipment can be aimed at.

[0029]

[Effect of the Invention] According to this invention, from the singularity of refuse incineration equipment, it comes to be able to perform a denitrogenization quality assessment with difficult evaluation from everyday performance data, and management, and improvement in reliability is achieved.

[Brief Description of the Drawings]

[Drawing 1] It is the figure showing the system of refuse incineration equipment of one

work example of this invention.

[Drawing 2] It is the control block diagram of the exhaust gas NOx removal equipment of one work example of this invention.

[Drawing 3] It is a flow chart for NOx-removal-efficiency calculation of the exhaust gas NOx removal equipment of one work example of this invention.

[Drawing 4] It is the figure showing the NOx-removal-efficiency conversion curve to the pouring molar ratio of the NOx removal equipment used for refuse incineration equipment of one work example of this invention.

[Drawing 5] It is the figure showing the NOx-removal-efficiency conversion curve to the gas volume of the NOx removal equipment used for refuse incineration equipment of one work example of this invention.

[Drawing 6] It is the figure showing the NOx-removal-efficiency conversion curve to the gas temperature of the NOx removal equipment used for refuse incineration equipment of one work example of this invention.

[Drawing 7] It is the figure showing the NOx-removal-efficiency conversion curve to the NOx concentration of the NOx removal equipment used for refuse incineration equipment of one work example of this invention.

[Explanations of letters or numerals] 1 Incinerator 2 Exhaust Gas Condensator 3 Alkali Spray Tower 4 Bug Filter 5 Catalyst NOx Removal Reactor 6 Chimney 7 Flue 8 Entrance NOx, O2 Analysis 9 [ a Total of ] Exit NOx, O2 Analysis Meter 10 Exit NH3 Analysis 11 [ a Total of ] Exhaust Gas Flow Instrument 12 NH3 Flow Instrument 13 Air Content Meter for Incineration 14 Gas Thermometer 15 Air Fan 16 Garbage Entrance Slot

[Translation done.]